CLAIMS

What is claimed is:

1. A replaceable filter element for a crankcase emission control assembly, the replaceable filter element comprising:

a ring of filter media circumscribing a central cavity and having a first end and a second end;

a first annular end cap sealingly attached to the first end of the filter media ring, said first end cap having a central opening into the central cavity of the filter media ring;

a second annular end cap sealingly attached to the second end of the filter media ring, said second end cap also having a central opening into the central cavity of the filter media ring, and

a cup-shaped valve pan fixed to the second end cap and defining therewith a sump container in fluid communication with the central cavity of the filter media ring; the valve pan having an end wall and a further central opening; and a resilient seal bounding the opening in the end wall of the valve pan.

2. The replaceable filter element as in claim 1, wherein the opening in the end wall of the valve pan is circular, and the seal radially inwardly bounds the opening.

3. The replaceable filter element as in claim 2, wherein the seal projects radially inward from the end wall into the opening.

4. The replaceable filter element as in claim 3, wherein the seal is co-planar with the end wall.

5. The replaceable filter element as in claim 1, wherein the seal is a lip seal.

6. The replaceable filter element as in claim 1, wherein the seal is unitary with the end wall.

7. The replaceable filter element as in claim 1, wherein the valve pan also includes a cylindrical sidewall fixed to the second end cap, and the end wall is planar.

8. The replaceable filter element as in claim 1, further including first and second annular side seals bounding the element at axially separated locations along the filter element.

9. The replaceable filter element as in claim 8, wherein the first side seal is integral with the first end cap, and the second side seal is integral with the valve pan.

10. The replaceable filter element as in claim 1, further including a cylindrical collar bounding the opening in the end wall of the valve pan and projecting outwardly, away from the valve pan and the filter element.

11. The replaceable filter element as in claim 10, wherein the collar is radially outwardly spaced from the seal.

12. The replaceable filter element as in claim 1, wherein the opening in the second end cap has a greater diameter than the opening in the end wall of the valve pan.

13. The replaceable filter element as in claim 1, further including a collar integral with the second end cap, bounding the central opening in the second end cap, and projecting axially inward into the central cavity.

14. A filter for a crankcase emission control assembly, the filter comprising:

a ring of filter media circumscribing a central cavity and having a first end and a second end;

a first end cap sealingly attached to the first end of the filter media ring, said first end cap having a central opening into the central cavity of the filter media ring;

a second end cap sealingly attached to the second end of the filter media ring, said second end cap having a central opening into the central cavity of the filter media ring, a sump container integral with the second end of the filter media ring and independent from the housing of the crankcase emission control assembly, the sump container in fluid communication with the central cavity of the filter media ring through the central opening in the second end cap; an end wall in the sump container; the end wall including a further central opening, and a resilient radial seal bounding the opening in the end wall of the sump container; and

wherein the filter is an integral unit and can be removed from the crankcase emission control assembly.

15. The filter as in claim 14, further including first and second annular side seals bounding the element at axially separate locations along the filter element, wherein the first side seal is integral with the first end cap, and the second side seal is integral with the sump container.

16. The filter as in claim 14, further including a cylindrical collar bounding the opening in the end wall of the sump container and projecting outwardly, away from the filter element.

17. The filter as in claim 14, wherein the opening in the second end cap has a greater diameter than the opening in the end wall of the sump container.

18. The filter as in claim 17, further including a collar integral with the second end cap, bounding the central opening in the second end cap, and projecting axially inward into the central cavity.

19. A crankcase emission control assembly, including a housing having a first port receiving blow-by gasses from an engine crankcase, a second port directing substantially oil-free gasses back to the engine crankcase, and a standpipe projecting axially upward from a lower portion of the housing toward an upper portion of the housing; a filter assembly in the housing removing suspended oil in the gasses as the gasses pass from the first port to the second port, the filter assembly including a filter element having an integral sump container collecting the oil when the oil is separated from the gasses, and an opening in the sump container with a resilient seal which closely receives the standpipe and seals with the standpipe to normally prevent blow-by gasses received in the first port from directly entering the sump container and by-passing the filter element, wherein collected oil in the sump container can drain through the standpipe when the oil collects in the sump container up to a level above an open end of the standpipe.

20. The crankcase emission control assembly as in claim 19, further including a drain port in the housing fluidly connected to the standpipe.

21. The crankcase emission control assembly as in claim 20, wherein the filter element is removably received in the housing and the filter assembly further includes a primary breather filter fixed in the housing.

22. The crankcase emission control assembly as in claim 21, wherein the housing includes a cylindrical sidewall and a removable cover allowing removal and replacement of the filter element from the housing.

23. The crankcase emission control assembly as in claim 19, wherein the filter element includes:

a ring of filter media circumscribing a central cavity and having a first end and a second end;

a first end cap sealingly attached to the first end of the filter media ring, said first end cap having a central opening into the central cavity of the filter media ring;

a second end cap sealingly attached to the second end of the filter media ring, said second end cap having a central opening into the central cavity of the filter media ring, wherein the sump container is defined at least in part by the second end cap of the filter element, and the sump container is in fluid communication with the central cavity of the filter media ring through the central opening in the second end cap.

24. The crankcase emission control assembly as in claim 23, further including a first annular resilient seal carried around the periphery of the first end cap for sealing with one portion of the housing, and a second annular resilient seal carried around the periphery of the sump container for sealing with another portion of the housing.

25. The crankcase emission control assembly as in claim 24, wherein the housing includes a cylindrical sidewall and a bottom wall, with the first port being provided centrally in the bottom wall, and the breather filter comprises an annular media member disposed toward the bottom of the housing with a central opening in surrounding relation to the first port, the blow-by gasses entering the first port passing radially-outward through the breather filter to the filter element, wherein the breather filter separates at least some of the suspended oil from the blow-by gasses entering the first port and the separated oil can then drain back through the first port to the engine crankcase.

26. The crankcase emission control assembly as in claim 25, wherein the replaceable filter element is positioned in the housing such that the sump container is toward the bottom of the filter element and adjacent the breather filter.

27. The crankcase emission control assembly as in claim 26, further including a peripheral chamber surrounding the filter element, wherein the blow-by gasses passing through the breather filter pass into the peripheral chamber and then flow radially inward through the filter element where substantially the remainder of the suspended oil is separated from the blow-by gasses, the remaining oil collecting in the sump chamber and being returned to the engine crankcase.